

WHAT IS CLAIMED IS:

1. A picture synthesizing apparatus comprising: image pickup means disposed in a car; viewpoint change image synthesizing means for changing a viewpoint of an image obtained by said image pickup means and synthesizing the image; car locus line generation means for generating at least one of a locus line at an arbitrary height of said car and a vertical line; and car locus line drawing means for drawing the locus line generated by said car locus line generation means on the image synthesized by said viewpoint change image synthesizing means.
2. The picture synthesizing apparatus according to claim 1 wherein said car locus line generation means comprises three-dimensional locus line generation means, road surface projection means, and synthesized image projection means.
3. The picture synthesizing apparatus according to claim 1 wherein said car locus line generation means generates a locus line in a case in which said car linearly advances.
4. The picture synthesizing apparatus according to claim 1, further comprising steering angle information output means for outputting a steering wheel angle of said car, wherein said car locus line generation means generates the locus line in

accordance with steering angle information outputted by said steering angle information output means.

5. The picture synthesizing apparatus according to claim
5 1 which has a function of interpolating a locus line on a road surface of said car and the locus line at the arbitrary height with a straight line or a curved line, and drawing a line vertical to said road surface on said synthesized image.
- 10 6. The picture synthesizing apparatus according to claim
1 which has a function of drawing a locus line of a bumper end of said car or a locus line of a car height on said synthesized image.
- 15 7. The picture synthesizing apparatus according to claim
1 which has a function of changing a color or a thickness of said locus line in accordance with a distance from said car and drawing the locus line.
- 20 8. The picture synthesizing apparatus according to claim
4 which has a function of drawing a section of said car moved apart from a rear end of said car along said locus line with an elapse of time on said synthesized image.
- 25 9. The picture synthesizing apparatus according to claim

4 which has a function of drawing a solid diagram of said car moved apart from a rear end of said car along said locus line with an elapse of time on said synthesized image.

5 10. The picture synthesizing apparatus according to claim 4 wherein said car locus line generation means comprises three-dimensional shape storage means, three-dimensional locus region generation means, road surface projection means, and synthesized image projection means.

10 11. The picture synthesizing apparatus according to claim 10 wherein said three-dimensional shape storage means stores a shape of said car.

15 12. The picture synthesizing apparatus according to claim 10 wherein said three-dimensional shape storage means stores a shape of a rectangular parallelepiped inscribed by said car.

20 13. The picture synthesizing apparatus according to claim 10 wherein said three-dimensional shape storage means stores a shape of a wheel of said car.

25 14. The picture synthesizing apparatus according to claim 10 wherein said three-dimensional shape storage means

stores a shape of a bumper of said car.

15. The picture synthesizing apparatus according to
claim 4, further comprising obstacle collision prediction means
5 for detecting an obstacle present around said car, and predicting
a possibility of collision of said car with said obstacle.

16. The picture synthesizing apparatus according to
claim 15 wherein said car locus line drawing means does not draw
10 the locus line of said car ahead of a collision place, when said
obstacle collision prediction means predicts the collision of
said car with said obstacle.

17. The picture synthesizing apparatus according to
15 claim 15 wherein said car locus line drawing means emphasizes
and displays a collision place, when said obstacle collision
prediction means predicts the collision of said car with said
obstacle.

20 18. The picture synthesizing apparatus according to
claim 4, further comprising multi-screen generation means for
displaying the image synthesized by said viewpoint change image
synthesizing means in a multiplicity of divided screens.

25 19. The picture synthesizing apparatus according to

claim 18 wherein said car locus line drawing means draws a locus of the car in each screen generated by said multi-screen generation means.

5 20. The picture synthesizing apparatus according to claim 18 wherein said image pickup means includes means for picking up an image behind said car, and means for picking up an image beside said car.

10 21. The picture synthesizing apparatus according to claim 18 wherein said car locus line drawing means draws a locus line of a rear end of said car on an image beside said car, or an image obtained by converting said image beside the car.

15 22. The picture synthesizing apparatus according to claim 19 wherein said car locus line drawing means draws the locus line or a car frame indicating the same position in the same color in different screens, when said locus line is drawn in a plurality of screens.

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23. A picture synthesizing apparatus comprising: image pickup means disposed in a car; viewpoint change image synthesizing means for changing a viewpoint of an image obtained by said image pickup means and synthesizing the image; auxiliary line generation means for generating an auxiliary line of an

arbitrary position from said car; and auxiliary line drawing means for drawing the auxiliary line generated by said auxiliary line generation means on the image synthesized by said viewpoint change image synthesizing means.

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24. The picture synthesizing apparatus according to claim 23, further comprising multi-screen generation means for displaying the image synthesized by said viewpoint change image synthesizing means in a multiplicity of divided screens, wherein
10 said auxiliary line drawing means draws the generated auxiliary line in each screen generated by said multi-screen generation means.

25. The picture synthesizing apparatus according to
15 claim 23 wherein said auxiliary line generation means generates an auxiliary line indicating a position of a rear end of said car.

26. The picture synthesizing apparatus according to
20 claim 23 wherein said auxiliary line generation means generates an auxiliary line indicating a constant distance from a rear end of said car.

27. The picture synthesizing apparatus according to
25 claim 23 wherein said auxiliary line generation means generates

an auxiliary line indicating a width of a general car.

28. A picture synthesizing apparatus comprising: image pickup means disposed in a car so that a rear part of said car
5 is positioned in a view field; viewpoint change image synthesizing means for changing a viewpoint of an image obtained by said image pickup means and synthesizing the image including an image of said car; storage means for storing predetermined data beforehand; and drawing means for superimposing
10 predetermined auxiliary data upon the image synthesized by said viewpoint change image synthesizing means based on the data read from said storage means.

29. The picture synthesizing apparatus according to
15 claim 28 which has a function of superimposing an auxiliary line upon a rear edge of said car, and providing an image emphasizing/indicating the corresponding position.

30. The picture synthesizing apparatus according to
20 claim 28 which has a function of providing an image showing a three-dimensional illustration prepared as if the image of said car were picked up by an actually disposed image pickup unit and converted/synthesized.

25 31. The picture synthesizing apparatus according to

claim 28 which has a function of representing said car by an illustration of a skeleton or a wire frame, and providing an image explicitly indicating a tire position.

5 32. The picture synthesizing apparatus according to claim 31 which has a function of providing an image obtained by transforming/synthesizing an image actually obtained by said image pickup means in a region corresponding to a bumper of the illustration.

10 33. The picture synthesizing apparatus according to claim 28 which has a function of superimposing an illustration of two wall surfaces disposed vertically to a road surface in a rear end position of said car, and on an inner side of the 15 rear end position of said car, and having the same width as a width of said car upon a displayed image, and providing an image metaphorically representing said car as a solid object.

20 34. The picture synthesizing apparatus according to claim 28 which has a function of providing an image showing a mirror confirmation line behind a rear end of a bumper of said car by a constant distance and horizontally with said bumper.

25 35. The picture synthesizing apparatus according to claim 28 which has a function of providing an image including

a road surface passage locus indicating a position obtained by projecting a position passed by a body end of said car onto a road surface, and a bumper end passage locus indicating a position passed by a bumper end of said car, when said car moves
5 backwards, and a solid auxiliary line for connecting the loci to produce a solid sense.

36. The picture synthesizing apparatus according to claim 35 which has a function of providing an image showing said
10 road surface passage locus like a tire trace, and indicating the bumper end passage locus connected to a bumper end of an actual image or an illustration of said car.

37. The picture synthesizing apparatus according to claim 35 which has a function of providing an image showing said
15 road surface passage locus drawn from a tire explicitly indicated in an illustration.

38. The picture synthesizing apparatus according to claim 37 which has a function of providing an image showing a mirror confirmation line behind a rear end of a bumper of said car by a constant distance and horizontally with said bumper.
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39. The picture synthesizing apparatus according to claim 35 which further comprises a locus calculation unit to
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calculate a predicted locus from a steering angle signal inputted from the outside, and which has a function of providing an image including a road surface passage locus corresponding to a steering angle of said car, a bumper end passage locus
5 corresponding to the steering angle of said car, and a solid auxiliary line for connecting the loci to produce a solid sense.

40. The picture synthesizing apparatus according to
claim 28 which has a function of providing an image
10 simultaneously showing a road surface passage locus, a bumper
end passage locus, a passage locus indicating a position passed
by an appropriate height portion of a body of said car, and an
illustration imitating a rear part of the car, when said car
moves backwards.

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41. The picture synthesizing apparatus according to
claim 40 which has a function of providing an image showing said
road surface passage locus like a tire trace, and indicating
said bumper end passage locus connected to a bumper end of an
20 actual image or an illustration.

42. The picture synthesizing apparatus according to
claim 40 which has a function of providing an image showing said
road surface passage locus drawn from a tire explicitly indicated
25 in an illustration.

43. The picture synthesizing apparatus according to
claim 42 which has a function of providing an image showing a
mirror confirmation line behind a rear end of a bumper of said
5 car by a constant distance and horizontally with said bumper.

44. The picture synthesizing apparatus according to
claim 40 which further comprises a locus calculation unit to
calculate a predicted locus from a steering angle signal inputted
10 from the outside, and which has a function of providing an image
simultaneously showing said road surface passage locus
corresponding to a steering angle of said car, said bumper end
passage locus corresponding to the steering angle of said car,
a passage locus indicating a position passed by an appropriate
15 height portion of a body of said car, and an illustration
imitating a rear part of said car.

45. The picture synthesizing apparatus according to
claim 28 which has a function of providing an image
20 simultaneously showing a road surface passage locus, a bumper
upper surface passage locus indicating a position passed by an
end of a bumper upper surface of said car, a bumper lower surface
passage locus indicating a position passed by an end of a bumper
lower surface of said car, and an illustration imitating a rear
25 part of said car, when said car moves backwards.

46. The picture synthesizing apparatus according to
claim 45 which has a function of providing an image showing said
road surface passage locus like a tire trace, and indicating
5 the bumper end passage locus connected to a bumper end of an
actual image or an illustration of the car.

47. The picture synthesizing apparatus according to
claim 45 which has a function of providing an image showing said
10 road surface passage locus drawn from a tire explicitly indicated
in an illustration.

48. The picture synthesizing apparatus according to
claim 47 which has a function of providing an image showing a
15 mirror confirmation line behind a rear end of a bumper of said
car by a constant distance and horizontally with said bumper.

49. The picture synthesizing apparatus according to
claim 45 which further comprises a locus calculation unit to
20 calculate a predicted locus from a steering angle signal inputted
from the outside, and which has a function of providing an image
simultaneously showing said road surface passage locus
corresponding to a steering angle of said car, said bumper upper
surface passage locus corresponding to the steering angle of
25 said car, said bumper lower surface passage locus corresponding

to the steering angle of said car, and an illustration imitating a bumper of said car.

50. An image synthesis/display apparatus comprising:

- 5 a picture synthesizing apparatus comprising: image pickup means disposed in a car; viewpoint change image synthesizing means for changing a viewpoint of an image obtained by said image pickup means and synthesizing the image; car locus line generation means for generating at least one of a locus line 10 at an arbitrary height of said car and a vertical line; and car locus line drawing means for drawing the locus line generated by said car locus line generation means on the image synthesized by said viewpoint change image synthesizing means;
- 15 display means for displaying the image synthesized by said picture synthesizing apparatus; and
- 20 display data conversion means for converting said image to be displayed into data suitable for said display means.

51. An image synthesis/display apparatus comprising:

- 20 a picture synthesizing apparatus comprising: image pickup means disposed in a car; viewpoint change image synthesizing means for changing a viewpoint of an image obtained by said image pickup means and synthesizing the image; auxiliary line generation means for generating an auxiliary line of an arbitrary 25 position from said car; and auxiliary line drawing means for

drawing the auxiliary line generated by said auxiliary line generation means on the image synthesized by said viewpoint change image synthesizing means;

- display means for displaying the image synthesized by said
5 picture synthesizing apparatus; and
display data conversion means for converting said image
to be displayed into data suitable for said display means.

52. An image synthesis/display apparatus comprising:
10 a picture synthesizing apparatus comprising: image pickup
means disposed in a car so that a rear part of said car is
positioned in a view field; viewpoint change image synthesizing
means for changing a viewpoint of an image obtained by said image
pickup means and synthesizing the image including an image of
15 said car; storage means for storing predetermined data
beforehand; and drawing means for superimposing predetermined
auxiliary data upon the image synthesized by said viewpoint
change image synthesizing means based on the data read from said
storage means;
20 display means for displaying the image synthesized by said
picture synthesizing apparatus; and
display data conversion means for converting said image
to be displayed into data suitable for said display means.
25 53. An image acquirement warning apparatus comprising:

detection means for detecting an approaching state of a connection object connected to a car;

- a picture synthesizing apparatus comprising: image pickup means disposed in said car and/or said connection object;
- 5 viewpoint change image synthesizing means for changing a viewpoint of an image obtained by said image pickup means and synthesizing the image; car locus line generation means for generating at least one of a locus line at an arbitrary height of said car and a vertical line; and car locus line drawing means
- 10 for drawing the locus line generated by said car locus line generation means on the image synthesized by said viewpoint change image synthesizing means; and

15 warning means for generating a warning signal from said approaching state obtained by said detection means and/or a relation between said car and said connection object in the image synthesized by said picture synthesizing apparatus.

54. An image acquirement warning apparatus comprising:
detection means for detecting an approaching state of a
20 connection object connected to a car;

a picture synthesizing apparatus comprising: image pickup means disposed in said car and/or said connection object;
viewpoint change image synthesizing means for changing a viewpoint of an image obtained by said image pickup means and
25 synthesizing the image; auxiliary line generation means for

generating an auxiliary line of an arbitrary position from said car; and auxiliary line drawing means for drawing the auxiliary line generated by said auxiliary line generation means on the image synthesized by said viewpoint change image synthesizing
5 means; and

warning means for generating a warning signal from said approaching state obtained by said detection means and/or a relation between said car and said connection object in the image synthesized by said picture synthesizing apparatus.

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55. An image acquirement warning apparatus comprising:
detection means for detecting an approaching state of a connection object connected to a car;
a picture synthesizing apparatus comprising: image pickup
15 means disposed in said car and/or said connection object so that a rear part of said car is positioned in a view field; viewpoint change image synthesizing means for changing a viewpoint of an image obtained by said image pickup means and synthesizing the image including an image of said car; storage means for storing
20 predetermined data beforehand; and drawing means for superimposing predetermined auxiliary data upon the image synthesized by said viewpoint change image synthesizing means based on the data read from said storage means; and
warning means for generating a warning signal from said
25 approaching state obtained by said detection means and/or a

relation between said car and said connection object in the image synthesized by said picture synthesizing apparatus.

56. The image acquirement warning apparatus according to
5 any one of claims 53 to 55, further comprising warning signal
generation condition setting means for a user to arbitrarily
set a condition for generating the warning signal by said warning
means.
- 10 57. A car position recognition apparatus comprising:
a picture synthesizing apparatus comprising: a plurality
of image pickup means disposed in a car, and including rear image
pickup means for picking up an image behind said car; viewpoint
change image synthesizing means for changing a viewpoint of an
15 image obtained by said image pickup means and synthesizing the
image; car locus line generation means for generating at least
one of a locus line at an arbitrary height of said car and a
vertical line; and car locus line drawing means for drawing the
locus line generated by said car locus line generation means
20 on the image synthesized by said viewpoint change image
synthesizing means;
image detection means for detecting an image of an
arbitrary object from the image obtained by said rear image
pickup means or the image synthesized by said picture
25 synthesizing apparatus;

recognition means for recognizing a position relation between the image detected by said image detection means and the image of said car; and

- comparison means for comparing said position relation
- 5 recognized by said recognition means with a predetermined position relation, and detecting a deviation amount between the position relations from the position relations.

58. A car position recognition apparatus comprising:

- 10 a picture synthesizing apparatus comprising: a plurality of image pickup means disposed in a car, and including rear image pickup means for picking up an image behind said car; viewpoint change image synthesizing means for changing a viewpoint of an image obtained by said image pickup means and synthesizing the
- 15 image; auxiliary line generation means for generating an auxiliary line of an arbitrary position from said car; and auxiliary line drawing means for drawing the auxiliary line generated by said auxiliary line generation means on the image synthesized by said viewpoint change image synthesizing means;
- 20 image detection means for detecting an image of an arbitrary object from the image obtained by said rear image pickup means or the image synthesized by said picture synthesizing apparatus;
- recognition means for recognizing a position relation
- 25 between the image detected by said image detection means and

the image of said car; and

comparison means for comparing said position relation
recognized by said recognition means with a predetermined
position relation, and detecting a deviation amount between the
5 position relations from the position relations.

59. A car position recognition apparatus comprising:
a picture synthesizing apparatus comprising: a plurality
of image pickup means disposed in a car, including rear image
10 pickup means for picking up an image behind said car, and disposed
so that a rear part of said car is positioned in a view field;
viewpoint change image synthesizing means for changing a
viewpoint of an image obtained by said image pickup means and
synthesizing the image including an image of said car; storage
15 means for storing predetermined data beforehand; and drawing
means for superimposing predetermined auxiliary data upon the
image synthesized by said viewpoint change image synthesizing
means based on the data read from said storage means;
image detection means for detecting an image of an
20 arbitrary object from the image obtained by said rear image
pickup means or the image synthesized by said picture
synthesizing apparatus;
recognition means for recognizing a position relation
between the image detected by said image detection means and
25 the image of said car; and

comparison means for comparing said position relation recognized by said recognition means with a predetermined position relation, and detecting a deviation amount between the position relations from the position relations.